Assessing carbon stocks & flux in California forests: what can FIA contribute?

Susan Willits

PNW FIA Portland

California Board of Forestry Workshop

Ensuring AB 32 Target for California Forests

Sacramento, CA

21 July 2008

Agenda

- I. What FIA can and can't do
- II. What we know from attempts to estimate a 1990 baseline
- III. Stuff we're working on or could work on

Part I: What FIA Can & Can't Do

FIA is:

- Nationally consistent inventory of forestland across all ownerships
- Statistical sample of Forests:

  Trees, Down Wood, Understory Veg, Lichens, Ozone, Soil
- Field Plots, Ownership surveys, Mill capacity surveys

What FIA CAN do….

- Provide *strategic level* information on forestland for *all owners*
- Provide *statistically based* information on the major aboveground carbon pools
- Provide *annual* updates to forestland information
- Provide re-measurement on a 10-year cycle

What FIA CAN do….

- Intensify with partner contributions
  - Spatially
  - Temporally
  - Variables
- Collaborate with others on analysis and techniques development

What FIA CAN'T do….

- Provide "real" remeasurement data for all of CA until 2016 (50%) to 2021 (100%)
- Provide fine scale estimates without intensification
- Force private landowners to participate – need to show them benefits
- Provide nationwide estimates –
  - AK, HI, MS, NM, NV, WY missing

Part II

What we know from attempts to estimate a 1990 baseline in California

What we found....

Good Estimates of AGLT **stocks** on all forestland

- 23% of California's live tree carbon is on reserved lands (which comprise 18% of CA forest area)
- 50% of reserved carbon is in NFS; the rest is in state and national parks
- Carbon stocks on NFS lands represent > 50% of CA forest carbon

Where we had trouble....

- Protocol and definition changes with annual inventory create problems with estimating trend over time (flux)
- Limited flux information can be estimated for lands outside National Forests based on data from 1980s and 1990s.
- Annual trend doesn't work when signal weak – need remeasurement of plots

Carbon on timberland outside National Forests (ONF) circa 1990

Tg of carbon

Year	Aboveground live tree	Below-ground biomass	Under-story vegetation	Dead wood	Soil organic	Litter	Total
1990 Estimates	296	63.2	10.8	61.9	133.7	93.0	658
Annual Flux	2.9	0.5	0.09	0.29	-0.09	-0.14	3.5

- 24 % of CA forest area/28% AGLT biomass
- Aboveground live tree is largest pool and accounts for greatest flux
- Soil & litter pools large, but flux small because insensitive to attributes assessed by FIA (predicted as function of stand age, forest type)
- Only aboveground live tree carbon is *calculated* from FIA measurements; other pools derived via allometric equations (e.g., from Smith and Heath)

What we know about stocks and flux

	Acres (millions)	Carbon per acre (Mg)		C Flux/acre/yr (Mg)	
		AGLT	All Pools	AGLT flux	All Pool Flux
ONF Timberland	8	37	83	0.36	0.44
ONF Other Forest	10	20	51	?	?
National Forest	15	33	78	?	?

- Remeasurement takes time – 2011 for 50% of NFS lands, 2016 for 50% of non-NFS, 2021 for 100% of CA
- Other Forest is a broad category including Redwoods & Oak Woodland – changes may be unclear

Lessons learned

- Lesson #1: While flux may be derived from stock change, it cannot be reliably derived from change in independently estimated stocks (i.e., periodic to annual)
- Lesson #2: Contemporary, statistically significant estimates of flux can't be expected until remeasurement data is in hand
- Lesson #3: Freezing protocols is essential for future ability to assess change

Other issues

- Estimates are based on models …. Which could use more work:
  - AGLT stocks and fluxes quite different with local volume equation pathway vs. national approximation
  - Stem volume equations have room for improvement
  - More species specific branch and bark biomass equations needed
  - Understory veg, Down wood, litter, soils are estimated with generalized equations – a thorough review of the models and availability of local data could improve this area

Part III

Stuff we're working on or could work on

Scale is Important

- CCAR looking to set carbon stocks targets that will determine who can receive payments
- Seeking to develop ecosection (12), forest type group (7), and productivity class (3) specific thresholds based on current stocks estimated by FIA
- But, many cells in this 252 cell table are empty or contain values based on too-few plots to generate reliable estimates, so lumping/aggregation unavoidable
  - FIA inventory was never designed or funded to generate reliable estimates at such fine scales

Lumping to achieve 30 plots

- Need ~30 plots to generate a reliable estimate
  - Achievable only if no splitting by productivity class
- 89 mixed conifer plots in Sierra ecosection (so reliable estimate will be possible)
  - but only 12 redwood plots in Central Coast; better to lump those with the 137 on the North Coast to generate a statewide estimate of carbon stocks per acre for redwood
- Some types have less than 30 even statewide:
  - True fir has 25
  - Lodgepole has 5
- Because of NFS intensification, most plots are <u>not</u> on private land– only ~1000 private land forested plots or partial plots with 70% of the data in hand (so ultimately ~1300 to work with)

What could get us there?

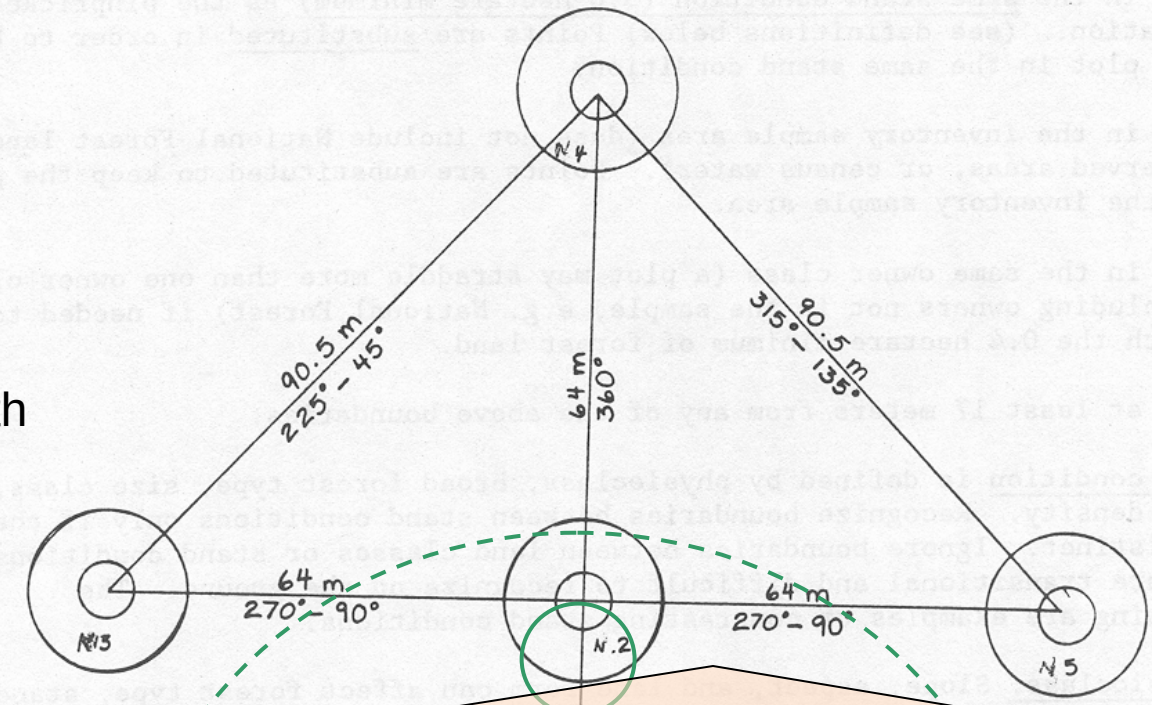
- Stop changing the forest inventory design/definitions
- Invest $$$ in volume & biomass equations
- Substantially increase plot density (3-4X) and reduce cycle length (by 50%)
- Focused, well-supported techniques research:
  - integrate plot, LiDAR and spectrally sensed information to enable spatially comprehensive, sufficiently precise models
- Except #1, these are unfunded
  - Perhaps 100+ million dollars for CA to do all these things

What we're doing this year

- Assess down wood/snag carbon via FIA plots and compare with Jenkins
- Assess live tree carbon stock change (and precision) for remeasured R5 plots and for Maine
- Complete work with Susanna Melson and Mark Harmon on equation selection sensitivity analysis
- Trying to build support for estimating better volume and biomass equations

Questions?

Old Growth



Regeneration